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VINEYARD IRRIGATION IN ARID CLIMATES

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There is much difference of opinion among grape growers in the Imperial Valley and similar regions as to the number, time, and volume of irrigations needed. Undoubtedly the main cause of this difference is the variation in character of the soils in which vines are growing.

What is the best way to irrigate vines in these regions? There is no single correct answer to this question. Each case is a special problem. To arrive at a satisfactory solution we must know (a) the water requirements of the vines and (b) the reaction of the particular soil to the water we apply; that is, how the water applied to the soil is absorbed, distributed, and lost.

Water Requirements of the Vine.—In winter, the vine is dormant and is then comparatively indifferent to the water content of the soil. So long as the soil is moderately moist around most of its roots it will not suffer from drought. On the other hand, it is equally resistant to excess of water at this time. When the vines are dormant, the vineyard may be flooded and the roots may stand in saturated soil for several weeks without injury. (Warning: The last remark does not apply to young vines just planted. Nursery rootings and, still more, cuttings, are very sensitive to excess of water and a few days in saturated soil may cause them to decay. It is only after they have made a year's growth and have an established root system that they acquire resistance to standing water. On the other hand, they are as resistant to dryness as are established vines.)

As soon as the activities of the vine are aroused by the warm weather of spring, it loses its indifference to the water content of the soil. When the new rootlets start, they quickly decay if the soil is so saturated with water that all air is excluded. Also when the buds start and produce leaves, these soon stop growing and wither if the soil moisture supply does not remain adequate for the young rootlets.

From this time until the harvesting of the crop, the vines will do their best only if the young feeding roots are growing in soil

containing all the water they can use but not so much as to exclude the air which they equally need. To determine this optimum degree of moisture requires observation and experience. Occasional borings with a soil auger should be made to at least four feet until experience has determined what is the best way of irrigating to get the required condition. If the water does not penetrate so deep as the roots, more irrigation is needed. If the soil at four feet or less remains muddy over 48 hours after irrigation, less should be applied.

The problem is relatively simple in deep soils which take water easily and where the drainage is good. In such soils there is little danger of over-irrigation. On the other hand, in shallow soils, that is, soils underlaid by impervious layers at four feet or less, the problem is often difficult.

In the first instance, one or two heavy irrigations early in the season followed by proper cultivation to prevent weed growth and excessive surface evaporation may be sufficient to provide the needed moisture conditions. In the second, a heavy irrigation is safe only in the winter while the vines are completely dormant. During the growing season, the vines must be supplied with the required moisture by frequent light irrigations and care taken to keep all the soil containing roots moist without being muddy. In such soils a number of two-inch test holes six feet deep supplied with a two-inch perforated iron pipe are useful as a means of determining the level of saturated soil. They should be placed in various parts of the vineyard, especially where the ground is lowest, and will do much to simplify the problem of applying sufficient water without danger of water-logging the soil. Frequent use of a soil auger is also advisable as a means of testing the moisture conditions.

Up to the harvest season, the water requirements of the vine are at their maximum. Water is required for new growth, for the development and maturing of the crop, and for the abundant foliage on which both of these activities depend.

After the harvest the requirements are less. All that is needed is sufficient moisture to keep the leaves in good working condition without promoting new growth. It is the work of the leaves after the crop is harvested that matures the canes and lays up the reserve stores of nutriment in the buds and other parts of the vine on which the healthy growth and crop of the following year largely depend. Too much water at this period is dangerous as it may stimulate continued development and growth of new shoots instead of properly maturing the canes and buds already formed.

Absorption, Distribution, and Loss of Water.—In order to satisfy the requirements of the vine the water must be applied differently, according to the nature of the soil.

If the soil is pervious, the water must be run in short furrows or small checks and with a relatively large "head." Otherwise the land near the head of irrigation will receive too much and that at the other end too little. If the soil takes water slowly, the furrows may be longer and the time of irrigation must be longer, to permit the water to penetrate to the required depth. If the soil is shallow, irrigations must be more frequent to keep a sufficient supply of water available to the vines at all times. In soils where water percolates downward more rapidly than horizontally, the irrigating furrows should be close.

The water which gets into the soil disappears by transpiration through the leaves of the vines, through weeds, and through intercrops, by evaporation from the surface of the soil, and by draining through the subsoil. The more leaf growth there is, therefore, the more water is needed; the better the cultivation, the less it is necessary to apply, and the better the drainage, the less danger there is of over-irrigation.

With so many factors it is difficult or impossible to establish definite rules. The best method can be determined only by careful trial and observation in the individual case.

Irrigation the First Year.—Before planting a vineyard, the soil should be wet to the depth that the roots can penetrate. This is the main irrigation and in deep soil furnishes a supply of water which is available to the vines all summer.

This preliminary main irrigation is essential in heavy and in shallow soils. In deep porous soils the main irrigation may be given after the vines are planted, but in relatively impervious soils it is difficult to give the large volume of water needed without danger of causing decay of young vines already in the ground. As soon as the soil works well after this irrigation, and before it becomes dry, the vines may be planted.

The next irrigation should be given soon after the vines have made a good start of roots and shoots. This irrigation should be light—sufficient simply to replace the water which has been evaporated from the upper soil. It is best applied in furrows close to and on each side of the vines. Later irrigations should be applied in the same way.

Young vines require comparatively little water. If the soil is kept cultivated sufficiently to prevent weed growth little is lost by evaporation and the needs of the vines are easily met. Cuttings and rootings will form roots over six feet long the first season. Too frequent summer irrigations tend to promote undesirable surface roots.

Late irrigations are dangerous with young non-bearing vines. Late irrigations promote late growth, which often fails to mature or is killed by frost. A large growth under these conditions is a detriment. Large vines which fail to mature their growth make less growth the following year than small vines which mature their wood early.

Irrigation the Second Year.—The irrigation the second year is similar to that of the first. The main irrigation should be given towards the end of winter before the vines start, providing the soil is not already amply supplied with moisture. Later irrigations should be light and should cease in time to allow the vine to mature its wood. The danger of late growth is even greater the second year than the first. As the vines now have a widely ramifying root system extending through all the soil, the water should be applied to all parts of the vineyard and not confined to furrows close to the vines.

Only in shallow or very open soils are more than two summer irrigations needed. In most cases, the last irrigation of young, non-bearing vines should not be later than July. When intercrops are grown, more water must be used to supply the needs of the intercrop, but in such a way that the intercrop removes the extra water. Weeds may sometimes have a favorable influence by removing surplus water during the late summer.

Irrigation of Bearing Vines.—The irrigation of bearing vines should in general follow the same course. The production of a crop, however, makes an extra demand for water. In many cases, a supplementary summer irrigation a little before the grapes ripen is advisable.

Where the crop is harvested early, as in the Imperial Valley, and especially in shallow soils, an irrigation after the removal of the crop may be useful or even necessary. This irrigation should be sufficient to keep the leaves green and in good condition until the weather commences to turn cool in autumn, but not sufficient to start a new growth of shoots. A gradual yellowing and dropping of the leaves from a diminishing water supply in November and early December are desirable.

SUMMARY

The main irrigation and the wetting of the subsoil should take place when the vines are dormant.

No part of the soil should remain muddy more than 48 hours while the vines are growing.

The soil should become sufficiently dry to stop new growth several weeks before the arrival of cold weather.

Young, non-bearing vines require less water than bearing vines and are very sensitive to injury from excess of water soon after they are planted, and from cold weather or frost if they are maturing new growth late in the autumn.